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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/822,535	03/30/2001	Erik S. Ruf	MS 160347.2/40062.120US01	1094
7590	02/10/2005		EXAMINER RUTTEN, JAMES D	
Homer L. Knearl Merchant & Gould P.C. P.O. Box 2903 Minneapolis, MN 55402-0903			ART UNIT 2122	PAPER NUMBER

DATE MAILED: 02/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

09/822,535

**Applicant(s)**

RUF, ERIK S.

**Examiner**

J. Derek Rutten

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 03 December 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 March 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on December 03, 2004 has been entered.
2. Currently, claims 1, 12 and 22 have been amended, no claims have been canceled, and no new claims have been added. Claims 1-23 remain pending in the application and have been fully considered by the examiner.

### ***Response to Arguments***

3. Applicant's arguments with respect to claims 1, 12, and 22 in view of prior art of record "C++: Effective Object-Oriented Software Construction" by Dattatri have been considered but are moot in view of the new ground(s) of rejection.
4. Applicant argued on page 7 paragraph 1 that FIG. 8 represents an implementation of the invention. This argument is not convincing. Upon inspection, Applicant's invention is not apparently embodied on any particular element of the figure. FIG. 8 is described on pages 22-25 of the originally filed specification. Page 22 lines 13-14 recite "The exemplary hardware and operating environment of FIG. 8 for implementing the invention includes a general purpose computing device in the form of a computer 20..." This suggests that the system exists

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separately from applicant's invention. Implementation of software in a hardware and operating environment is well known in the art. Pages 23-24 give a general description of computer components, and page 25 discusses where applicants invention could be implemented on those components. In particular, note the permissive language "may be incorporated" and "may be stored." Such language leaves room for these elements to exist separately from applicant's invention. Furthermore, Fig. 1 of U.S. Patent 6,044,155 to Thomlinson discloses an essentially identical figure more than one year prior to applicant's application. Thus, the objection to the drawing is maintained.

5. Applicant argued on page 7 paragraph 2 that a rule was not found indicating that such an implementation figure had to be labeled as "prior art". Applicant is referred to MPEP § 608.02(g).

6. Applicant argued on page 9 paragraph 4 that Bacon does not create an optimized instruction that obviates the need for a function call. However, review of Bacon reveals such an optimized instruction. See page 392, Figure 51(b):  $y = f\_CACHE[i]$  is an optimized instruction that obviates the function call  $y = f(i)$  appearing in Figure 51(a). Thus, the argument is not convincing.

### *Drawings*

7. Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Figure 1 is described in detail in the "Background of the Invention" section appearing on pages 1 and 2 of the originally filed specification. The figure is used to exemplify the problems that exist in the prior art, and as such is not new. The

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methods shown in the figure do not return constants in an embodiment of the present invention, rather, these methods are obviated by applicant's optimized instruction that returns the constants. See page 3 lines 13-16 of the originally filed specification. Although applicant may claim that the class hierarchy shown in the figure is processed more efficiently due to applicant's invention, the class hierarchy itself is not claimed as the invention.

8. Figure 8 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Also, see response presented in the above "Response to Arguments" section.

9. Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Objections***

10. Claim 12 is objected to because of the following informalities: The addition of the word "that" produces a slightly confusing clause in line 5 of the claim. The first occurrence of the word "that" as the second word in the line should likely be removed. Appropriate correction is required.

***Claim Rejections - 35 USC § 101***

11. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

12. Claims 22 and 23 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claims 22 and 23 are directed toward “A compiler”, which is a computer program that can be regarded as a data structure. Data structures and computer programs that are not claimed as embodied in computer-readable media are descriptive material per se and are not statutory because they are neither physical “things” nor statutory processes. See, e.g., Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760. Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention which permit the data structure's functionality to be realized. In contrast, a claimed computer-readable medium encoded with a data structure defines structural and functional inter-relationships between the data structure and the medium which permit the data structure's functionality to be realized, and is thus statutory.

***Claim Rejections - 35 USC § 103***

13. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

14. Claims 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over prior art of record, “Compiler Transformations for High-Performance Computing” by Bacon et al. (hereinafter referred to as “Bacon”) in view of “Memoization in top-down parsing” by Johnson (hereinafter “Johnson”).

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In regard to claim 1, Bacon discloses:

*generating a return constant table having an entry associated with a constant return value of the target method of the receiver object; See pages 391-392, Section 6.8.9:*

Memoization is an **optimization** that is applied to **side-effect free procedures** (that is, procedures that do not change the state of the program, also called referentially transparent). In such cases it is possible to cache the results of recent invocations. When the procedure is called again with the same arguments, the cached result is used instead of recomputing it [Abelson and Sussman 1985; Michie 1968].

Further, see the example in Figure 51 on page 392 where the table, or “cache” real

`f_CACHE[n]` is created to store the constant return value of the target method.

*generating an optimized instruction in association with the call site to retrieve, without requiring a function call, via the return constant table the constant return value associated with the target method.* As cited above, see Figure 51 on page 392. The function call to `f(i)` is replaced with a table lookup to `f_CACHE[i]`. The original function call `y = f(i)` in Figure 51(a) is replaced with the optimized instruction `y = f_CACHE[i]` appearing at the end of Figure 51(b).

Bacon does not expressly disclose a computer program product, or objects.

However, in an analogous environment, McNamee teaches a computer program product.

See page 22, 1<sup>st</sup> column 2<sup>nd</sup> paragraph:

We are developing a Java memoization tool and we encourage feedback on ways to improve a C++ utility. The C++ package can be obtained electronically at:  
<http://apl.jhu.edu/~paulmac/c++-memoization.html>

McNamee further teaches the use of the object-oriented language C++ which inherently provides objects. It would have been obvious to one of ordinary skill in the art at the

time the invention was made to use McNamee's teaching of program product and objects with Bacon's memoization. One of ordinary skill would have been motivated to transform exponential time algorithms to run in linear time (See page 17 paragraph 1).

In regard to claim 2, the above rejection of claim 1 is incorporated. Bacon further discloses the insertion of a constant return value in a cache (pages 391-392, Section 6.8.9).

In regard to claim 3, the above rejection of claim 1 is incorporated. Bacon further discloses the insertion of a constant return value in a separate cache (pages 391-392, Section 6.8.9 as referenced above). Bacon does not expressly disclose a dispatch table. However, McNamee teaches memoization in the C++ programming language which inherently provides a dispatch table. Upon transformation of a function to a memorized function, a return constant table is generated that is no longer associated with the dispatch table. See Figure 1 lines 10-19.

In regard to claim 4, the above rejection of claim 3 is incorporated. Bacon further discloses using a cached result with a procedure (page 391 Section 6.8.9 and page 392 Figure 51).

In regard to claim 5, the above rejection of claim 1 is incorporated. Bacon further discloses the determination of a procedure as being non-transformable (page 391, Section



6.8.9, paragraph 1: “side-effect free”), and insertion of a return value into a cache (page 391 Section 6.8.9, paragraph 1).

In regard to claim 6, the above rejection of claim 1 is incorporated. Bacon further discloses: evaluating a plurality of possible target methods for the identification of constant return values (pages 391, Section 6.8.9, 1<sup>st</sup> paragraph).

In regard to claim 7, the above rejection of claim 1 is incorporated. Bacon further discloses the application of function memoization only in the case when there are no side-effects (page 391 Section 6.8.9 paragraph 1).

In regard to claim 8, the above rejection of claim 1 is incorporated. Bacon further discloses the generation of fetching instructions for retrieval of a return value from a data structure (page 392 Figure 51).

In regard to claim 9, the above rejection of claim 1 is incorporated. Bacon further discloses evaluating a plurality of possible target methods and identification and storage of return values (pages 391-392, Section 6.8.9).

In regard to claim 10, the above rejection of claim 1 is incorporated. Bacon further discloses constant propagation including:

*identifying a restricted set of one or more values of a control variable associated with a control operation (page 380 Figure 35: “n=64”);*

*identifying a restricted set of one or more types associated with the restricted set of one or more values of the control variable (Compilers inherently identify the types of variables used in the programs that they analyze. Without type identification, a compiler might attempt calculations with two incompatible pieces of data.); and*

*optimizing one or more control targets associated with the control operation based on the restricted set of one or more types (pages 379 and 380, Section 6.6.1 and Figure 35).*

In regard to claim 11, the above rejection of claim 1 is incorporated. Bacon further discloses constant propagation including:

*identifying a restricted set of one or more values associated with a control variable (page 380 Figure 35: “n=64”);*

*identifying one or more target methods providing the values associated with the restricted set (page 380 Figure 35);*

*mapping between the restricted set of values of the control variable and a restricted set of types based on the one or more target methods (Mapping values of variables and types or methods is an inherent operation of compilers. Without mapping, a compiler might attempt calculations with two incompatible pieces of data.); and*

*optimizing one or more control targets associated with the control statement based on the restricted set of types (pages 379 and 380, Section 6.6.1 and Figure 35).*

In regard to claim 12, Bacon discloses a method. See the 1<sup>st</sup> paragraph of Section 6.8.9 appearing on page 391. All further limitations have been addressed in the above rejections of claims 1 and 6.

As per claims 13-21, the above rejection of claim 12 is incorporated. Further, all other limitations have been addressed in the above rejections of claims 2-4 and 6-11, respectively.

As per claims 22 and 23, all limitations have been addressed in the above rejections of claims 1 and 10, respectively.

### ***Conclusion***

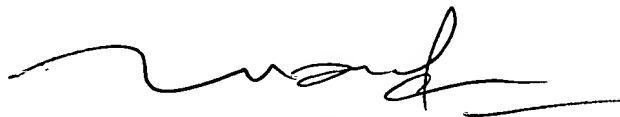
Any inquiry concerning this communication or earlier communications from the examiner should be directed to J. Derek Rutten whose telephone number is (571) 272-3703. The examiner can normally be reached on M, T, Th, F 6:00 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on (571) 272-3695. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jdr

A handwritten signature in black ink, appearing to read 'Tuan Dam', with a long horizontal flourish extending to the right.

**TUAN DAM  
SUPERVISORY PATENT EXAMINER**